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Flexible ontogenetic niche shifts: Pattern and timing of emergence of salmon alevins

Oppiaine Läroämne
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Tiivistelmä Referat
Ontogenetic niche shifts are changes in, for example, morphology, food source, or habitat, which occur at a particular developmental stage. Atlantic salmon emergence is an ontogenetic shift in habitat. Adult salmon bury their eggs in stream-bottom gravel (the redd). After hatching the young fish remain in the redd until their endogenous yolk sac reserves near depletion. At this stage they emerge into the stream. In theory, ontogenetic habitat shifts should occur when the expected ratio of growth to mortality in the second habitat exceeds that experience in the first. The timing of salmon emergence is clearly affected by water temperature and by photoperiod. I was interested in the influence of perceived competition or predation risk. Fry compete for feeding territories, and floaters are unlikely to survive. There is probably a prior residence effect in competition for feeding territories. Thus, emerging earlier that the bulk of conspecifics could be advantageous. However, predation pressure on newly emerged fish, particularly the first emergents, is very high and this may mean that delaying emergence to a larger body size is more advantageous.

Chemical cues are important signals in aquatic systems, and both behavioural and morphological responses to predator cues have been found in fish. In this study I looked at whether chemical cues indicating competition (growth potential), or predation risk, can alter the timing of a life history switchpoint. More specifically, whether cues from predators (brown trout and burbot), feeding conspecifics, or food alone, influence salmon emergence. I predicted that predator odours would delay emergence to a larger body size, promote synchrony of emergence, and promote emergence during darkness. I also predicted that the odours of competing conspecifics and fry food would stimulate alevins to emerge earlier, at a smaller body size.

All practical work was carried out at the Saimaa Fisheries Research and Aquaculture in Enonkoski, Finland. I incubated salmon eggs from wild-caught parents in 40 artificial redds with continual throughflow of water. Water supply to redds was from one of five treatments. These were; (i) trout (predator), (ii) burbot (predator), (iii) 15 salmon fry (feeding conspecifics), (iv) fry feed alone (to control for food effects in (iii)), and (iv) lake water alone (control). Emerged fry were removed three times daily, and date, water temperature, time of day (in relation to photoperiod), parental cross and treatment were recorded. Body length and yolk sac area of fry were later measured from photographs. Treatment effects on emergence date, body size, relative yolk sac size, and photoperiodicity and synchrony of emergence were analysed. Changes in water temperature were controlled for in the analyses.

There was more nocturnal emergence of fry in all 'odour' treatments than in the control. Nocturnal emergence may be a general precautionary response to unfamiliar cues. There was a behavioural response of delayed emergence in the burbot treatment relative to the control. Burbot migrate to deeper waters in the summer months, so even a short delay in emergence may reduce the probability of burbot predation in nature. Trout odour, however, stimulated emergence, and slowed growth rate. Downstream displacement may be the best strategy for survival if a trout is resident near the redd, and a slowed growth rate and use of yolk sac resources might prolong survival. Neither conspecific nor food cues altered emergence date. Perhaps natural food would have stimulated emergence, although artificial food did not. Alternatively, perhaps the predation risk to early emergents is so strong that food cues will never stimulate emergence.

The influence of rising water temperatures on emergence is also discussed.

Avainsanat - Nyckelord
Atlantic salmon, body size, chemical cues, competition, emergence, photoperiod, predation, *Salmo salar*, timing, water temperature, yolk sac size

Säilytyspaikka - Förvaringställe
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Muita tietoja